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HISTOPLASMOSIS: Prevention and Control in Kentucky

Histoplasmosis is an infection that results from inhaling spores of the dimorphic fungus *Histoplasma capsulatum*, and primarily affects the lungs. Kentucky is in an area of the United States in which exposure to the infectious agent causing histoplasmosis is common. In some areas of the state up to 95% of the residents have been exposed to *H. capsulatum*.¹ Fortunately, most people exposed to low concentrations of the organism do not develop clinical illness. However, there are certain situations that increase the likelihood of becoming ill.

In 1995, there were two work-related Kentucky outbreaks of histoplasmosis associated with the demolition or repair of old buildings. These 2 incidents resulted in 39 clinical cases, with 6 people requiring hospitalization.¹ Late in 1997, a local health department in the western part of the state investigated another work-related outbreak. In the 1997 outbreak, 5 clinical cases occurred and 4 of the workers required hospitalization.² During the 1991-1997 period, 127 individual cases of histoplasmosis were added to Kentucky's Reportable Disease Registry.³

Most reported outbreaks of histoplasmosis share the same scenario: People who caused or were near disturbances of dusty material contaminated with *Histoplasma capsulatum*, inhaled spores of the fungus and became ill. They did not know the health risks associated with their activity. Consequently, they took insufficient or no precautions to protect their health or the health of others nearby.

Public and professional education will reduce the risk of potential outbreaks as more Kentuckians recognize risks for exposure to *H. capsulatum*, and learn ways to protect themselves and others from potentially contaminated airborne dusts. The following health, safety and environmental guidelines are adapted from a document prepared by the National Institute for Occupational Safety and Health (NIOSH) and the National Center for Infectious Diseases (NCID) of the Centers for Disease Control and Prevention (CDC).

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HISTOPLASMOSIS AND RISK FACTORS

What is histoplasmosis?

Histoplasmosis is an infectious disease caused by inhaling the spores of a fungus called *Histoplasma capsulatum*. It is not contagious; it cannot be transmitted from an infected person or animal to someone else.⁵

Histoplasmosis primarily affects a person's lungs, though its symptoms vary greatly. The vast majority of infected people are asymptomatic, or they experience symptoms so mild they do not seek medical attention and may not even realize that their illness was histoplasmosis.⁶ If symptoms do occur, they will usually start within 3 to 17 days after exposure, with an average of 10 days.⁵ Histoplasmosis can appear as a mild flu-like respiratory illness with a combination of symptoms including malaise, fever, chest pain, dry or nonproductive cough, headache, loss of appetite, shortness of breath, joint and muscle pain, chills, and hoarseness.⁵⁻⁸ A chest X-ray can reveal distinct markings on an infected person's lungs.

Chronic lung disease due to histoplasmosis resembles tuberculosis and can worsen over months or years, and special antifungal medications are needed to arrest the disease.^{5-6,9}

The most severe and rarest form of this disease is disseminated histoplasmosis, which involves spreading of the fungus to other organs outside the lungs. Disseminated histoplasmosis is fatal if untreated,⁵⁻¹⁰ but the same outcome can occur in some patients even with medical treatment.⁹ People with weakened immune systems are at greatest risk for developing severe and disseminated histoplasmosis. Included in this high-risk group are persons with acquired immunodeficiency syndrome (AIDS) or cancer and persons receiving cancer chemotherapy, high-dose long-term steroid therapy, or other immuno-suppressive drugs.^{6,9,11-15}

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Impaired vision and even blindness occur in some people

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from a rare condition called presumed ocular histoplasmosis.¹⁶ The factors causing this condition are only poorly understood. Results of laboratory tests suggest that presumed ocular histoplasmosis is associated with hypersensitivity to *H. capsulatum* and not from direct ocular exposure to the microorganism. Delayed events that convert the condition from asymptomatic to symptomatic are unknown.¹⁷

Where are *Histoplasma capsulatum* spores found?

H. capsulatum grows in soils throughout the world.^{11,26} In the United States, the fungus is endemic and the proportion of people infected by *H. capsulatum* is higher in central and eastern states, especially in regions along the valleys of the Ohio, Mississippi, St. Lawrence, and Rio Grande rivers.^{8,27} The fungus seems to grow best in soils with high nitrogen content, especially those enriched with bird manure or bat droppings. In endemic regions of the United States, active and inactive roosts of blackbirds, starlings, and grackles have been found heavily contaminated by *H. capsulatum*.^{23, 28-39} Soil in a stand of trees where blackbirds have roosted for three or more years should be suspected of being contaminated by the fungus.^{32,40} Habitats of pigeons^{28-30,41-44} and bats,^{28,45-59} and dirt floors of poultry houses^{28,60-65} have also been found contaminated by *H. capsulatum*.

Exposure to fresh bird droppings is probably not an important health risk for histoplasmosis because birds have not been shown to be infected by *H. capsulatum*.^{23,66} Rather, bird manure serves as primarily a nutrient for growth of *H. capsulatum* already present in soil.²⁰ The organism can be carried on the wings, feet, and beaks of birds and infect soil under roosting sites or manure accumulations inside buildings. Unlike birds, bats can become infected with *H. capsulatum* and consequently can excrete the organism in their droppings.^{20,50,53,67}

Who can get histoplasmosis and what jobs and activities have risks for exposure to *H. capsulatum* spores?

Anyone working at a job or being near activities where material contaminated with *H. capsulatum* becomes airborne can develop histoplasmosis if enough spores are inhaled. After an exposure, the extent of illness experienced varies greatly and most likely depends on the number of spores inhaled and a person's age and susceptibility to the disease. The number of inhaled spores needed to cause disease is unknown. Infants, young children, and older persons, in particular those with chronic lung disease, are at increased risk for developing symptomatic histoplasmosis.^{11,70}

The U.S. Public Health Service (USPHS) and the Infectious Diseases Society of America (IDSA) have jointly published guidelines for the prevention of opportunistic infections in persons infected with the human immunodeficiency virus

(HIV). Concerning the prevention of exposures to *H. capsulatum* by HIV-infected persons, the USPHS/IDSA Prevention of Opportunistic Infections Working Group recommended that "they should avoid activities known to be associated with increased risk (e.g., cleaning chicken coops, disturbing soil beneath bird-roosting sites, and exploring caves)."⁴ An HIV-infected person should consult a health care provider about appropriate exposure precautions to be taken for any activity with a risk of exposure to *H. capsulatum*.

If someone develops flu-like symptoms days or even weeks after disturbing material potentially contaminated with *H. capsulatum*, and the illness worsens rather than subsides after a few days, medical care should be sought and the health care provider informed about the exposure.

Should workers who may be exposed to *Histoplasma capsulatum* have pre-exposure skin or blood tests?

Workers at risk for exposure to *H. capsulatum* may learn useful information from a histoplasmin skin test. The results of skin testing would inform each worker of his or her status regarding either susceptibility to infection by *H. capsulatum* (a negative skin test) or partial resistance to reinfection (a positive skin test). However, a false-negative skin test may occur early in an infection or with persons with weakened immune systems,^{6,8,11,19,23} and a false-positive skin test may result from cross-reaction with antigens of certain other pathogenic fungi.^{8,27} One potential drawback to routine pre-exposure skin testing, however, is that a person with a positive skin test might incorrectly assume a false sense of security that he or she was completely immune to reinfection.

How is histoplasmosis diagnosed?

Diagnosis of histoplasmosis can be made by identifying *H. capsulatum* in clinical samples of a symptomatic person's tissues or secretions, testing the patient's blood serum for antibodies to the microorganism, and testing urine, serum, or other body fluids for *H. capsulatum* antigen. On occasion, diagnosis may require transbronchial biopsy.¹¹

Culturing clinical specimens

Culturing clinical specimens is a standard method of microbial identification, but the culturing process for isolating *H. capsulatum* from clinical samples is costly and time-consuming.¹⁷ Also, positive results are seldom obtained during the acute illness, except for clinical specimens from patients with disseminated histoplasmosis.^{6,9,11,17-19} Research advances in polymerase chain reaction (PCR) technology suggest a laboratory method may soon be available that will directly identify pathogenic fungi in clinical samples without the need for culturing.²⁰⁻²¹

Serologic tests

Most cases of histoplasmosis are diagnosed serologically.¹¹ Serologic test results may be useful when positive, but they can be negative in patients who are sick with histoplasmosis, especially in patients with weakened immune systems.^{6,11,18} Because of their convenience, availability, and utility, the most widely accepted serologic tests used in the diagnosis of histoplasmosis are the immunodiffusion test and the complement-fixation (CF) test.^{8,17-19}

Detection of *H. capsulatum* antigen

A radioimmunoassay method can be used to measure *H. capsulatum* polysaccharide antigen (HPA) levels in samples of a patient's urine, serum, and other body fluids.^{9,17,23-24} The test meets the important need for a rapid and accurate method for early diagnosis of patients with disseminated histoplasmosis, especially those with AIDS.^{9,17,24} HPA is detected in body fluid samples of most patients with disseminated infection and in the urine and serum of 25% to 50% of those with less severe infection.¹⁷

Histoplasmin skin test

A person can learn from a histoplasmin skin test whether he or she has been previously infected by *H. capsulatum*. This test, similar to a tuberculin skin test, is available at many physicians' offices and medical clinics. A histoplasmin skin test becomes positive 2 to 4 weeks after a person is infected by *H. capsulatum* and usually remains positive for life.¹⁸ Previous infection can provide partial immunity to reinfection.²² Because a positive skin test does not mean that a person is completely immune to reinfection,²² appropriate exposure precautions should be taken regardless of a worker's skin-test status. Furthermore, while histoplasmin skin test information is useful to epidemiologists, a positive test does not help diagnose acute histoplasmosis, unless a previous skin test is known to have been negative.^{5,6,8,11}

Testing of soil samples

To learn whether soil or droppings are contaminated with *H. capsulatum* spores, samples must be collected and cultured. The culturing process involves inoculating mice with small portions of a sample, sacrificing the mice after 4 weeks, and streaking agar plates with portions of each mouse's potentially infected liver and spleen.²⁸ Then for 4 more weeks, the plates are observed for growth of *H. capsulatum*. If not enough samples are collected, small but highly contaminated areas can be overlooked. On several occasions, *H. capsulatum* was not recovered from any environmental samples collected from material believed responsible for causing illness in people diagnosed with histoplasmosis through clinical samples.^{29-30,42,49,68-69}

Until a less expensive and more rapid method is available, testing environmental samples for *H. capsulatum* will be impractical for many situations. Consequently, when

thorough testing is not done, the safest approach is to assume soil in endemic areas and any accumulations of bat droppings or bird manure are contaminated with *H. capsulatum* and to take appropriate exposure precautions.

REDUCING EXPOSURES

What can be done to reduce exposures to *Histoplasma capsulatum* and the risk for histoplasmosis?

Excluding a colony of bats or a flock of birds

The most protective work practices are clearly those that would prevent accumulations from occurring in the first place. For example, when a colony of bats or a flock of birds is discovered roosting in a building, immediate action should be taken to exclude the intruders. One should begin by identifying and sealing all entry and exit points for the bats or birds. This step can be more complicated if bats are the problem, because some bats are so small that they can squeeze through an opening smaller than the diameter of a dime.⁴⁰

Posting health risk warnings

If bats or birds are allowed to live in a building or a stand of trees, their manure will accumulate and create a health risk for anyone who enters the roosting area and disturbs the material. Once a roosting area has been discovered, exclusion plans should be made, and the extent of contamination should be determined. Areas known or suspected to be contaminated by *H. capsulatum*, such as bird roosts, attics, or even entire buildings that contain accumulations of bat or bird manure, should be posted with signs warning of the potential health risk.

Communicating health risks to workers

Before an activity is started that may disturb any material potentially contaminated by *H. capsulatum*, workers should be informed in writing of the personal risk factors that increase an individual's chances of developing histoplasmosis. Written hazard communication information should include a warning that individuals with weakened immune systems are at greatest risk of developing severe histoplasmosis if infection occurs.

Work practices and dust control measures

The best way to prevent exposures to *H. capsulatum* spores is to avoid situations in which potentially contaminated materials can become aerosolized and subsequently inhaled. A brief inhalation exposure to highly contaminated dust aerosolized during a work activity can cause infection and development of histoplasmosis. Therefore, work practices and dust control measures that eliminate or reduce dust will also reduce a person's risk of infection and subsequent development of disease. For example, instead of shoveling or sweeping dusty material,²⁹ dust suppression methods, such as carefully wetting dry material with a water spray, can be

useful for reducing the amount of dust aerosolized during an activity. An alternative to bagging contaminated material, such as indoor bird or bat manure accumulations, is use of industrial vacuum cleaners with high-efficiency filters. High-volume, truck-mounted vacuum systems are recommended for removal of large accumulations. These methods will serve to reduce dust generation and consequently the number of spores available for inhalation.

Removal and disposal of all material potentially contaminated by *H. capsulatum* will also eliminate any further risk that someone might be exposed to aerosolized spores. Air sampling, surface sampling, or the use of any other test method intended to confirm that no infectious agents remain following removal of bat or bird manure accumulations is unnecessary in most cases. However, before a removal activity is considered finished, a visual inspection of the cleaned area should be made to ensure that no residual dust or debris remains.

Disinfectants

Disinfectants have occasionally been used to treat contaminated soil and accumulations of bat manure for which removal was impractical or as a precaution before a removal process was started.^{31,37-39,49,55} Formaldehyde solutions are the only disinfectants proven to be effective for decontaminating soil containing *H. capsulatum*.^{31,37-39} Because of the potentially serious health hazards associated with formaldehyde exposures, it should be handled only by persons who know how to apply this chemical safely.⁴⁶

Waste disposal

Any material potentially contaminated with *H. capsulatum* that is removed from a work site should be disposed of or decontaminated properly and safely and not merely relocated to an area where it could still be a problem. Before an activity is started, the quantity of material to be removed should be estimated. Also, requirements established by local and state authorities for the removal, transportation, and disposal of contaminated material should be obtained. Before starting a removal project, arrangements should be made with a landfill operator concerning the quantity of material to be disposed of, the dates when material will be delivered, and the disposal location. Incineration of contaminated material before burial may be necessary in some situations.

Construction, excavation, and demolition activities

Dusts containing *H. capsulatum* can be aerosolized during construction, excavation, or demolition activities. Disturbances of contaminated material cause small *H. capsulatum* spores to become airborne or aerosolized, and once airborne, spores can easily be carried by wind currents over long distances. Such contaminated airborne dusts can cause infections not only in workers but also in others nearby. City or county governments in areas endemic for *H. capsulatum* should establish and enforce regulations

concerning work practices that will control dust aerosolization at construction, excavation, and demolition sites.

Because soil in endemic areas can contain *H. capsulatum*, water sprays or other dust suppression techniques should be used to reduce the amount of dust aerosolized during construction, excavation, or demolition activities. During windy periods or other times when dust suppression techniques are rendered ineffective, earthmoving activities should be interrupted. All earthmoving equipment (e.g., bulldozers, trucks, and front-end loaders) should have cabs with air-conditioning (if available) to protect their operators. Air filters on equipment air-conditioners should be inspected on a regular schedule and cleaned or replaced as needed. During filter cleaning or replacement of exceptionally dusty air filters, respiratory protection should be worn by the person doing the maintenance if there is a potential for dust to become aerosolized. Also, the beds of all trucks carrying dirt or debris from a work site should be covered, and all trucks should pass through a wash station before leaving the site. When at a dump site, a truck operator should ensure that all individuals in the vicinity will not be exposed to dust aerosolized while the truck is emptied.

Dusty conditions during work activities in bird roosts located in areas not considered endemic for histoplasmosis have resulted in outbreaks of the disease.^{30,34} Consequently, regardless of whether a work site is in an endemic area, precautions should be taken at active and inactive bird roosts during construction or excavation activities that might cause dust aerosolization.

Pre-demolition considerations

Water sprays and other suppression techniques may not be enough to control dust aerosolized from a building or other structure during its demolition. Consequently, removal of accumulations of bird or bat manure from a building before it is demolished may be necessary. Factors affecting a decision concerning this pre-demolition measure include the quantity and locations of accumulated manure, the structural integrity or soundness of the building, environmental conditions, and the proximity of the structure to be demolished to other buildings occupied by persons who may be at increased risk for developing symptomatic histoplasmosis (e.g., schools, day-care facilities, hospitals, clinics, jails, and prisons.)

Personal protective equipment

Because work practices and dust control measures to reduce worker exposures to *H. capsulatum* have not been fully evaluated, the use of personal protective equipment will still be necessary for some activities. For example, during removal of an accumulation of bat or bird manure from an enclosed area like an attic, wearing a NIOSH-approved respirator and possibly other items of personal protective equipment are

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recommended to further reduce the risk of *H. capsulatum* exposure.

INFORMATION RESOURCES

Environmentalists at local health departments in Kentucky serve as the primary responders to inquiries related to histoplasmosis. The environmentalists will contact the Kentucky Department for Public Health, Division of Public Health Protection and Safety, about any inquiries, recommendations and actions taken. Division staff are responsible for contacting other appropriate state and federal agencies.

Before demolition or renovation contact:

- Local health department environmentalists.
- Division of Public Health Protection & Safety, Kentucky Department for Public Health, David Nichols (502)564-4856.

When an outbreak is suspected contact:

- Local health departments
- Division of Epidemiology and Health Planning, Kentucky Department for Public Health, Dr. Clarkson Palmer 502-564-3261 or Dr. Michael Auslander 502-564-3418.

A two-page fact sheet, an abbreviated version of the guidelines, is available from the Kentucky Department for Public Health. The fact sheet is intended for distribution by employers, health agencies, unions, and cooperatives to help educate workers and the public about histoplasmosis. Contact David Nichols at 502-564-4856 .

For a copy of the complete NIOSH/NCID guidelines, contact Steve Lenhart, National Institute for Occupational Safety and Health,

Welcome to Kentucky
Dr. Caldwell
April 1, 1998



The Kentucky Department for Public Health is pleased to announce that the Patton Administration has approved the appointment of Glyn G. Caldwell, M.D. as Director, Division of Epidemiology and Health Planning, effective April 1, 1998. Dr. Caldwell, a retired officer of the United States Public Health Service, was assigned to the Chronic Diseases Division of the Centers for Disease Control and Prevention in Atlanta, Georgia. He has also served as State Epidemiologist and Deputy Director of the Arizona Department of Health Services and Director of the Tulsa City-County Health Department.

Dr. Caldwell has extensive experience in chronic disease epidemiology, the study of time-space cancer clusters, and radiation exposed populations. In addition, he worked on a variety of infectious disease problems, including acquired immunodeficiency syndrome. He has participated in epidemiologic studies related to environmental hazards at Three Mile Island, Love Canal, the Nevada Nuclear Test Site and the Hanford Nuclear Facility in Richland, Washington. Dr. Caldwell is currently a member of the Hanford Health Effects Subcommittee of the Citizens Advisory Committee on Public Health Activities and Research at Department of Energy Sites for the Agency for Toxic Substances and Disease Registry. He also serves as a consultant to the Nevada Agency for Nuclear Projects, Community Health Information Project, related to the nuclear waste disposal site at Yucca Mountain.

Dr. Caldwell has a Master of Science in medical microbiology and is a Fellow of the American College of Epidemiology.

His diverse background and extensive experience in chronic disease, toxic exposures, and medical radiation will strengthen the Department for Public Health expertise for the Commonwealth's increasing needs in chronic diseases and environmental health.

We extend a warm welcome to Dr. Caldwell as he joins the Kentucky Department for Public Health's team. His telephone number is 502-564-7243.

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